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Workshop 1

Evaluation of NASA Space Grant Consortia Programs

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Abstract

The meaningful evaluation of the NASA Space Grant Consortium and Fellowship Programs must overcome unusual difficulties: a) the program, in its infancy, is undergoing dynamic change; b) the several state consortia and universities have widely divergent parochial goals that defy a uniform evaluative process; and c) the pilot-sized consortium programs require that the evaluative process be economical in human costs lest the process of evaluation comprise the effectiveness of the programs they are meant to assess. This paper represents an attempt to assess the context in which evaluation is to be conducted, the goals and limitations inherent to the evaluation, and to recommend appropriate guidelines for evaluation.

Introduction

The NASA Space Grant Program inaugurated in September 1989 was designed to catalyze the development of ideas, programs, and a broad-based institutional commitment and infrastructure that will, in the long run, satisfy the following explicitly or implicitly stated objectives:

1. To arouse the interest of a generation of K-12 students in mathematics and science, to improve their levels of competency in such subjects, and to stimulate their collective interests in, preparation for, and dedication to careers in diverse technologically-based disciplines.
2. To arouse the interest of the general public in aerospace-related activities of NASA and other governmental and private agencies, to get John and Mary Q. Public to stop yawning at the day-to-day successes of NASA et al., To develop a public appreciation for the scientific and technological challenges of aerospace science and technology, to develop and understanding of the scientific and technological benefits to accrue from a vigorous program of aerospace-related research and development, to develop a public understanding of the economic benefit of such programs to the nation, indeed, to convince the public that such programs are imperative to our economic health and national security.
3. To engender broad-based public support and the associated political constituency necessary for budgetary commitments essential to realize these objectives.

4. To co-opt increasing devotion of resources from State, Federal, and private agencies toward aerospace-related research and development and human resource development.
5. To assure a stream of well qualified and motivated technologically educated students being graduated at the BS, MS, and PhD levels, adequate to meet the needs of NASA, DOD, and our aerospace industries, and thereby preserve and enhance our technological competitiveness, balance of payments, national economy, and national security.
6. Affirmative action goals to enhance the opportunities for affected minorities and women are an independent objective and inherent to and a necessary condition to the meeting of the above stated five goals. Given the demographics of the work force projected for the coming decades, even the most mean-spirited, socially retrograde, morally perverse, but intelligent individual, would adopt as a Machiavellian strategy, a strong pro-affirmative action bias.

The above stated long-term objectives of the Space Grant Program define the context in which one can attempt evaluation of the National program and several State Consortia. The resources currently allocated to the task are woefully inadequate to fulfill the above goals but they can encourage the development of a cadre of committed people and institutions, and the establishment of effective means of communications among them.

Goals of the Evaluation Process

All that can be asked of the current programs at the current levels of funding commitment is the demonstration of promising approaches, and the identification of pitfalls, and promising looking but blind alleys, so that, when (not if) Congress, NASA, the States and private industry develop the resolve to provide the levels of investment necessary to attack problems that must be attacked we will do it with greater wisdom and efficiency.

Thus, the primary purpose of the evaluation process must be to set the stage for a cost-effective scaleup of the operations of the Space Grant Program. Since significant institutional and individual stakes will be riding on these evaluative assessments they will be necessarily biased.

Limitations to the Evaluation Process

Don Griffin, formerly of Westinghouse's Bettis Atomic Power Labs articulated what I will call, Griffin's Law:

"Under the best of circumstances, the product of objectivity and expertise in any one observer is a constant."

This "law", somewhat reminiscent of Heisenberg's Uncertainty Principle, articulated in the context of evaluation of high technology programs in a different discipline is applicable to NASA's goal of evaluation of the Space Grant Program. We will have to rely to a considerable extent on people with an "ax to grind" to prepare the evaluations. The best that we can do is to require that the bases for the evaluations be clearly articulated, that the underlying data be public, that the authors of the evaluations be identified, and that those responsible for reviewing the evaluations do so with clear understanding of the inherent biases of the authors. I am sufficiently sanguine with regard to human nature to trust to the basic intellectual integrity of the evaluators (ensemble average) not to fabricate the data. On the other hand, there will be wishful thinking that manana we will see the light at the end of the tunnel and our programs will be productive.

NASA has already missed (I believe) the opportunity to perform the evaluations with scientific rigor. To do so they should have rank ordered all of the Space Grant Proposals and funded all of the odd-ranked proposals, denying funding to the even-ranked proposals. One could then compare the performances of paired States with universities of inherently comparable qualities and would-be PI's of comparable imagination and enthusiasm. Such a controlled experiment would then allow one to isolate the effect of NASA funding on the outcomes. NASA was probably wise not to conduct such an experiment. The basic message is that we shall be hard pressed to measure the extent to which the NASA funding was the cause of the measurable advances. Those institutions and individuals represented at this meeting are aggressive, capable, and dedicated to the Space Grant goals. They would have found alternative ways to achieve some of the successes that we shall report.

It should also be noted that the Space Grant Program is only one of many factors that will affect the realization of the above stated goals. The overall state of the national and world economies, the national perception of the relative severity and importance of social problems, the worldwide geopolitical trends and Congress' and State legislative reactions to them, particularly as they may affect funding for DOD, NASA, and education, can be expected to have major impacts on the very variables that one would like to evaluate to assess the NASA Space Grant Program.

Conclusions and Recommendations

The Space Grant Program is in it's infancy. We are just beginning on the learning curve. The resources allocated to the problems are at the proof-of-concept level. The several Consortia are starting from diverse positions, have established diverse initial strategies, have articulated diverse short-term and long-term goals, dictated by conditions parochial to their specific situations. Accordingly, the following criteria for evaluation are recommended:

1. Quantitative Space Grant-wide objective functions should not be defined to evaluate individual programs.
2. It will probably be useful to gather data on standard quantitative measure of productivity (enrollments, degrees granted, papers published, patents awarded...) to report for the NASA Space Grant Program at large. The data will be of most interest in terms of year-to-year changes.
3. First year results should not be given heavy weight. The evaluations of the programs should be made over a longer haul.
4. Significant experimentation with and modification of programs is anticipated in the early years of the programs. Evidence of internal evaluation and responsive adaptation of program strategies is to be encouraged. Wherever possible such evaluation processes should be designed into the programs to assure timely feedback. Such internal use of evaluation should be the primary purpose of Consortium evaluations.
5. The consortia should be encouraged to develop parochially appropriate (that doesn't mean self-serving) evaluative criteria.
6. The evaluative criteria and means of assessment should be anticipated to be dynamic in the early years of the program.
7. From annual review of the individual criteria and evaluative processes will evolve a more systematic and common basis for evaluation as the programs mature.
8. NASA should provide early general guidance for the manner in which evaluation issues are to be treated in the September annual report.

9. It is our understanding that the first step in the Consortium internal evaluation process is to review the NASA RFP goals and to restate them in Consortium-specific terms.
10. During the formative years the primary thrust of the evaluation process is to assess overall national program effectiveness.
11. Longer-term evaluation of the national program and the consortia should ask the basic questions: Did we achieve the development of an effective network? Did we provide meaningful space-related experiences for students? Did we achieve leverage from the seed funding? Did we achieve a genuine commitment from our universities, industry, NASA and other public agencies?
12. We must avoid the development of an overly formalized and burdensome evaluation process, disproportionate to the programmatic size and level of effort.

For all the reasons stated herein, ultimate assessment of evaluations will remain to some extent subjective, requiring sagacity and judgment, and an ability to look beyond statistics to form a valid gestalt assessment of program(s) effectiveness.